Monochromie

Fine Art Inkjet Practice

Characterization, Validation & Colorimetric Baseline

Carbon Ink: Epson Advanced Black-and-White (ABW)

© Yves Gauvreau, Sainte-Adèle, Québec, 2026

Context

This document defines the technical framework of the Monochromie series, three titles, *Granges*, *Rêves*, and *Fleur*, each produced in a digital and a printed edition.

This work is about black-and-white fine art photography, printed on fine art paper. For me, the print is the performance. It is the form the image was always meant to take.

Ansel Adams characterized every film he used, determining its effective sensitivity through his own equipment and development process so that he could expose with precision and predict his results. That empirical discipline is the model, but with digital cameras I have to take color into account. What follows is the protocol by which the same discipline is applied to a digital pipeline.

Foundation

> *"The negative is the score, the print is the performance." — Ansel Adams*

The pipeline runs from camera to monitor to printer, paper, and inks. Every device in that chain must be fine-tuned to function as a unified system.

The process is as follows: calibration, characterization, and validation.

With the system calibrated, I make the creative adjustments that render the image as I envision it on the print.

Equipment & Materials

Camera

Nikon D610 (24.3 MP, full-frame FX) and D810 (36.3 MP, full-frame FX).

Monitor

BenQ SW270C (primary, color-managed) and BenQ SW240 (secondary, not color-managed, used for palettes and reference tasks).

Printer

Epson SureColor P700 with UltraChrome Pro 10: ten channels. In Advanced Black-and-White mode, the driver routes output through the carbon-based channels (Photo Black, Matte Black, Light Black, Light Light Black) with controlled contributions from the chromatic channels to achieve a neutral grayscale response.

Paper

Hahnemühle Photo Rag, 188 g/m². 100 % cotton rag, acid-free, very low OBA content, natural white matte surface; archival permanence to ISO 9706.

Spectrophotometer

X-Rite i1Pro 2, serial number 1104157.

White tile calibration performed before each measurement session. Calibration standard: XRGA.

Three measurement modes recorded for every patch set: M0 (no UV filter), M1 (ISO 13655, calibrated UV), and M2 (UV excluded). Illuminant D50, observer 2°.

Software:

Role	Software
Target generation & profile creation	ABWProfileMaker (Gray, 2025)
Profile computation engine	ArgyllCMS (Gill, 2025)
Print output & soft proofing	Adobe Photoshop
Measurement & analysis	i1Profiler / PatchTool

Camera Characterization

Modern cameras can produce finished images directly, akin to having my film processed at the neighborhood film lab, but instantly. Here, I develop my own RAW files.

At the capture stage, the camera is operated at the limit of the sensor's dynamic range, which is essentially optimizing the signal-to-noise ratio (SNR).

The protocol is as follows: the RAW data is developed using `dcraw_emu` from LibRaw, a straightforward and transparent converter that applies only the necessary steps to reconstruct the image in RGB space:

- `-w` — camera white balance
- `+M` — embedded color matrix
- `-H 2` — highlight blend recovery
- `-q 12` — AAHD demosaicing
- `-o 4` — ProPhoto RGB output color space
- `-4` — linear 16-bit output, no gamma, no auto-brightness
- `-T` — TIFF output

The result is a linear, scene-referred 16-bit ProPhoto RGB image.

The camera's matrix-based conversion and white balance produce an acceptable starting point, typically yielding a ΔE_{00} in the 10 to 20 range depending on lighting conditions. For more accurate results, I derive a 3D LUT from a ColorChecker reference shot and apply it in Photoshop. Together, these two measures bring the average ΔE_{00} below 2.

The Master Image

I refer to these color-corrected, `dcraw_emu`-processed images as my master images. They represent the closest approximation of what the camera recorded under the given lighting conditions. From this point forward, the images can be interpreted according to my intent.

The master file is the score from which the final image is rendered. Tonal adjustment, color interpretation, and printing: this is where the photograph takes on its final form, "the performance."

Monitor Characterization

The monitor is the primary interface between the master image and the print. Properly calibrated and characterized, it provides an accurate simulation of what the paper will render, making tonal and creative decisions reliable before committing to paper.

Monitor: BenQ SW270C, calibrated with Palette Master Ultimate.

Calibration results (BenQ SW270C, 2026-03-08):

	Target	*Result*
Luminance	160 cd/m²	160 cd/m²
White point	CIE D50 (5003 K) x:0.3457, y:0.3585	5044 K x:0.3444, y:0.3569
Gamut	Adobe RGB R x:0.640, y:0.330 G x:0.210, y:0.710 B x:0.150, y:0.060	Measured R x:0.642, y:0.330 G x:0.210, y:0.711 B x:0.154, y:0.062
Black point	0.5 cd/m²	0.55 cd/m²

Avg ΔE	2.0	0.73
Max ΔE	4.0	1.34

Display standard: ISO 12646: color display for graphic technology appraisal, D50 / 5000 K, luminance 160 cd/m², ambient illuminance $\leqslant$ 20 cd/m².

Printer Characterization

Printer characterization answers a simple but essential question: what does the printer actually do when I send it a given value? The answer is captured in an ICC profile, which maps the full tonal range the printer can deliver on the chosen paper.

Characterization Target, 5 × 52 Patches

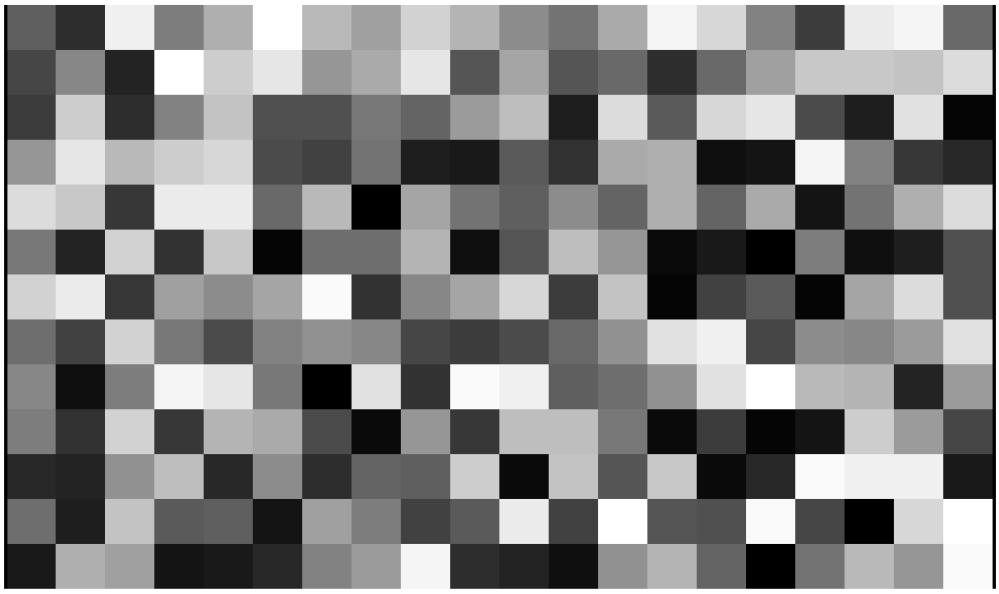
The characterization target is generated by ABWProfileMaker (Gray, 2025): 5 columns × 52 rows = 260 patches, covering the full luminance range.

The target is printed from i1Profiler without color management, and measured after 24 hours.

Driver settings at time of characterization:

Setting	Value
ABW tone	Neutral
Media type	Hahnemühle Photo Rag
Resolution	2880 × 1440 dpi
Print quality	Best Photo
High speed	Off

Repeat_5x_Neutrals_52_I1Pro2



Printed 5 × 52 characterization target (260 patches) on Hahnemühle Photo Rag 188 g/m², Epson SureColor P700, ABW mode. Source: ABWProfileMaker (Gray, 2025).

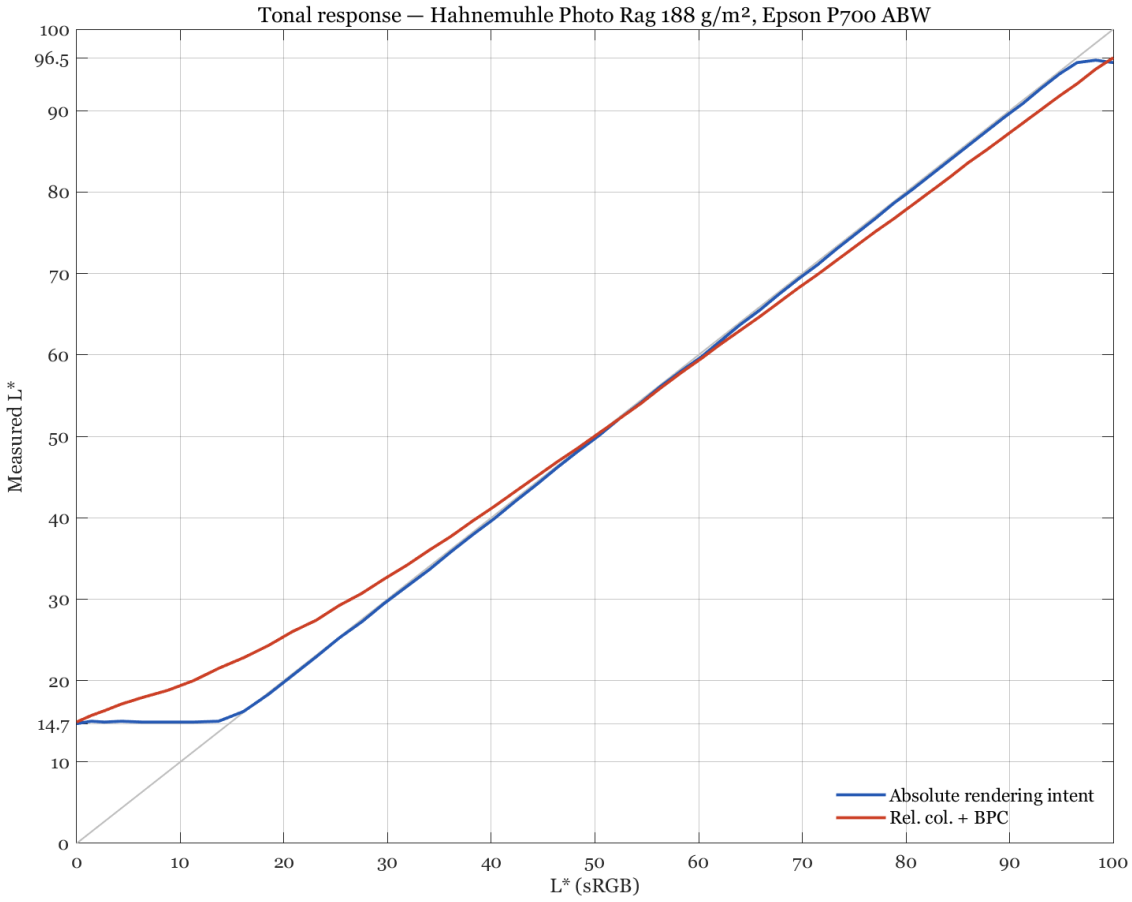
Measurements

Instrument: X-Rite i1Pro 2 (serial 1104157). Measurement mode: M1. Illuminant D50, observer 2°.
Calibration standard: XRGA.

Target measured in i1Profiler; results exported as CGATS text and used with ABWProfileMaker (Gray, 2025) + ArgyllCMS (Gill, 2025) for profile computation.

Profile Validation

Profile validation is a test to verify that the profile behaves as intended. A 256-patch target covering the full range of $R = G = B$ values is printed twice through the profile: once with Absolute Colorimetric rendering intent (black curve), and once with Relative Colorimetric and Black Point Compensation (red curve). Both are then measured with the i1Pro 2 in M1 mode. Both curves show a well-behaved profile.



Soft Proofing

The soft proof is the stage where the final rendering is determined. Tonal decisions (shadow compression, highlight rolloff, midtone contrast) are made against what the paper can deliver. For this, the paper color is measured and is set as the application background color so the eye adapts to the paper's actual white, giving an accurate perceptual context for evaluating the soft proof.

Recommended Photoshop soft-proof settings:

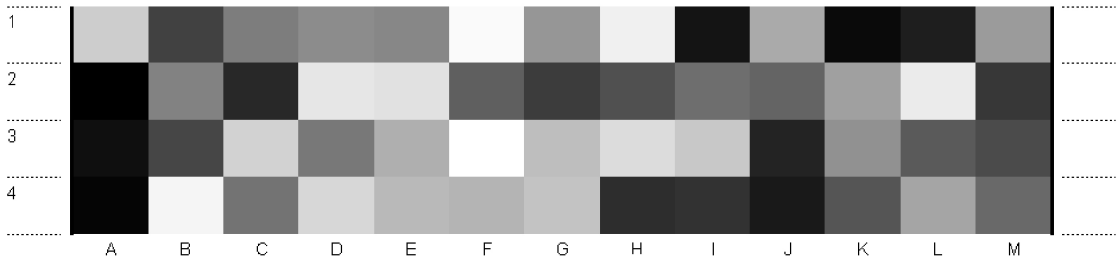
Setting	Value
Profile	Custom ABW Hahnemühle Photo Rag profile
Intent	Relative Colorimetric
Black Point Compensation	On
Simulate Paper Color	On
Simulate Black Ink	On
Set Background color	Measured paper white (Lab 96 1 -1 / `#f5f3f5`)

Colorimetric Baseline Project

This project is a long-term initiative for monitoring print stability. A registry identifying the institutions holding copies from the Monochromie series is maintained and made available here: https://archive.org/details/gauvreau-monochromie-editions/registry.txt

This project is conceived to become an open and distributed record. Should measurements of the included reference targets be carried out over time, and should those results be shared, they may accumulate into a meaningful trace of print permanence under real storage conditions. Whether it takes shape is left to those who come after me.

The reference target included with each copy consists of 52 neutral patches with $R = G = B$ values of 0, 5, 10, …, 255. It is assigned the sRGB color space and printed through the ABW pipeline using the custom ABW ICC profile, with relative colorimetric rendering intent and black point compensation. This target serves as a Day 0 colorimetric baseline, enabling the longitudinal tracking of tonal stability.



This is the target used in each copy of the edition.

Day 0 Measurements

Wilhelm Imaging Research rates the display permanence of Epson UltraChrome Pro10 carbon inks on cotton rag at over 400 years (ABW mode Album / Dark Storage) (Wilhelm Imaging Research, 2023). Day 0 measurements of the reference target provide the means to compare with future measures, and see the degradation over time.

Measurement conditions:

Parameter	Value
Instrument	X-Rite i1Pro 2, serial 1104157
Calibration	White tile, start of session
Standard	XRGA
Illuminant	D50
Observer	2°
Reference	M1 (ISO 13655, calibrated UV)
Date	recorded per file

Day 0 measurements are performed by me at the time each copy is completed, using the instrument and conditions described above. Results are published as CGATS text files, one set per copy, at:

```
https://archive.org/details/gauvreau-monochromie-editions/
  pdfs/
    Monochromie_de_granges_Gauvreau.pdf
    Monochromie_de_reves_Gauvreau.pdf
    Monochromie_en_fleur_Gauvreau.pdf
    Fine_Art_Inkjet_Practice_Gauvreau.pdf
  granges/
    C01_YYYYMMDD_M0.txt
    C01_YYYYMMDD_M1.txt
    C01_YYYYMMDD_M2.txt
    ABW_C01_YYYYMMDD_M1.txt
  reves/
    …
  fleur/
    …
```

Files are organized by edition and identified by copy number and date. Each copy's dataset includes M0, M1, and M2 measurements together with the statistical summary derived from the M1 file using ABWProfileMaker (Gray, 2025), archived and available for independent reproduction.

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Du même auteur / By the same author

Gauvreau, Yves. *Monochromie en fleur*. Sainte-Adèle : Yves Gauvreau, 2026.

Gauvreau, Yves. *Monochromie de granges*. Sainte-Adèle : Yves Gauvreau, 2026.

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